

Draft Minutes of SVS-GA/FAA Workshop

10/21, 10/22, 10/23, and 10/24

Lou Glaab

Attendance list:

#	Last name	First name	Affiliate	E-mail	Phone #	Oct-02
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Total for 10/2002 40

Actual agenda

Monday, October 21st, 2002

1500 Static demonstration of NASA LaRC Cessna-206 Jason Sweeters

Tuesday, October 22nd, 2002

0830 Welcome and Introductions George Finelli
0845 SVS-GA Overview Lou Glaab
0915 Low-Visibility Loss of Control experiment results Mamad Takallu
0945 Break
1015 Terrain Portrayal for Head-Down Displays (TP-HDD, sim) Monica Hughes
Preliminary Results
1115 TP-HDD, flight Preliminary Results Lou Glaab
1245 Lunch NASA Cafeteria
1230 GAWS Demo-1 Frank McGee
1445 Capstone-2 status August Asay
1600 Chelton EFIS-2000/Capstone-2/Outlook Rick Price
1645 Adjourn
1700 TP-HDD completion celebration (all invited!)
LAA Picnic Grounds

Wednesday, October 23rd, 2002

0815 Universal Vision-1 FAA certification effort Tom Johnson
0850 FAA SVS Certification Perspective Lowell Foster
1000 Symbology Development for Head-Down Displays Mamad Takallu
Experiment Overview
1100 Certification Issues catalog/future research needs Lou Glaab
1130 GAWS Demo-2 Frank McGee
1130 Static demonstration of NASA LaRC Cessna-206 Jason Sweeters
1300 Cessna-206 Flight Demo #1 Tom Johnson
1400 Cessna-206 Flight Demo #2 Rick Price
1500 Cessna-206 Flight Demo #3 August Asay
1600 Cessna-206 Flight Demo #4 Don Streeter
1700 Cessna-206 Flight Demo #5 Steve Wenke

Thursday, October 24th, 2002

0900 Cessna-206 Flight Demo #6 Steve Darr
1000 Cessna-206 Flight Demo #7 Dick Newman
1300 Cessna-206 Flight Demo #8 Eddie Norris

Draft Minutes

Oct 22, 2002

Welcome and Introduction (George Finelli):

- No comments

SVS-GA Overview (Lou Glaab):

- Experimental controls on ERAU exp
 - “Glass” pilot group will have to perform additional training to obtain their Instrument Rating.

Low-Visibility Loss of Control Experiment (Mamad Takallu):

- What order were displays used?
 - Randomized
- Did subjects have access to gages?
 - Yes, attitude indicator changed
 - Subjects could get attitude info from either SV display or gages
- Effects of hilly vs flat terrain noted?
 - Only hilly terrain employed for this test.
- Conventional EAI issues discussed
 - Pilot scanning
- Training on display symbology explained
- Did any of the groups (AI, EAI, SVS) get close to LVLOC?
 - Yes – AI (one incident)
- Eye tracker information would have been valuable

TP-HDD sim (Monica Hughes):

- Terrain database discussion
 - Seasonal effects on PR imagery discussed
 - SVS imagery collected during summer months
 - No effort to account for seasonal effects
 - Best, easiest to see imagery is considered the primary concern
 - WGS84 standard for terrain models
 - Terrain validation
 - Databases within certified TAWS products so far (participants):
 - 30 arcsec
 - 6 arcsec
 - 3 arcsec for specific airports
 - Steve Young provided discussion regarding state of DB efforts (certification of processes, DBs, and standardization).
 - Commercial terrain products

- Del Croom provided a discussion regarding commercial data products.
- FOV discussion
 - High altitude upsets need a good pitch scale (Chip Adams)
 - Don't require pilots to select a good pitch scale if an upset occurs.
 - The current pitch scale was developed over years of testing and is a significant point/condition.
 - Point of view (conformal or not)
 - Variable scales on selectable displays
 - Tunnel on/off: FOV control was the same. This could pose a control/display interaction effect.
- Terrain awareness data: Self assessment method
- Cooper-Harper scatter question
 - Discussion of method of C-H scale use was provided by Lou Glaab
 - May reflect more display preference than actual workload assessment.
- How were the effects of turbulence in the sim calibrated in a non-motion simulator?
 - Sim sessions with test/check pilot to establish appropriate levels
- Tunnel on vs off questions
 - With no tunnel MX20 in terrain mode, no dogbones
 - Size of tunnel constant, distance between changes
- Questions about Rare Event concerning experimental setup and expected results
- Fish Net (FN) discussion
 - Below 200 ft the FN is known to be a distractor due to the rapid changes based on testing related to the Universal concept (ed-thought this test involved 6 pilots. Half were in favor, half strongly disliked it).
 - TP-HDD results were that some strongly disliked it (masked roads, rivers some times), some thought it was Ok, but not worth much.
 - Noted that some users derive benefit from the fishnet cue (speed and distance).
 - FN familiarity and understanding of the FN could help.
- PR (alpha) – EBG (color) blended imagery noted as a potential experiment for further consideration of PR texturing.

TP-HDD flight (Lou Glaab):

- Strategic/Tactical terrain integration discussion
 - Use of the MX-20 in terrain mode may be reflecting things that are particular to the MX-20 (i.e. the way it shows terrain in terrain mode).
 - Other types of strategic terrain portrayal may change integration philosophy.
- FOV is wider for GA than for CAB aircraft

Capstone-2 Status (August Asay):

- Regarding the question of the reliability of the University of Anchorage system that was installed
 - August noted that dual AHRS were employed for operational capabilities to support flights to/from various sites.
 - Backup AHRS could be used if there was a problem with the primary unit.
- Number of attitude sources: 3 (2-AHRS+conventional unit)
- PFD loss/reversionary modes: MFD can show PFD if unit fails
- Certification of aircraft
 - IFR certified.
 - Expected in early November.
- WAAS discussion
 - Most valuable part of WAAS was the integrity property
 - WAAS can also provide another altitude source
 - Related NPRM to be released
 - Improved FDE(?) and RAIM
 - 129 GPS didn't have integrity monitor
 - Current rules don't accommodate RNAV without ground-based transmitter
- ADS-B discussion
 - AK terrain too rugged for radar coverage
 - No ground based transceivers (GBTs) until next September
- No concept of "partial panel" under glass concepts
- Predictor construction/implementation differences noted
- Terrain databases could use "peaks database", ASMD-like decimation
- Certification of Capstone-2 equipment
 - NAS wide (not just in AK)
 - Aircraft equipment available in September (ed?)
 - Lots of flight testing going on
 - Software still be changed, but concluding shortly
 - Certification in November (one only at this time)
 - No show-stoppers at this point
 - Significant issues:
 - Malfunction failure annunciation
 - No partial panel
 - Attitude failure
 - Turn and bank indicator requirement
 - ERAU aircraft under multiple aircraft STC (December)
- Course deviation indicator (CDI) drive:
 - Velocity vector based director bars from other nav sources (like ILS)
- Velocity Vector (VV) discussion
 - Air-mass for vertical drive? (ed lots of discussion with this one. I don't think Chelton' VV is a pure air-mass thing. They use H-dot

- (pressure) with some acceleration to quicken it. Since ground speed is employed, this is not an air-mass VV).
 - Turbulence conducive to VV PIO
 - VV is dampened which has improved the performance and made it Ok.
- Tunnel discussion
 - The tunnel can be turned off (menu selectable) to facilitate use of the VV with the runway image for late-final guidance (ed-less than 2nm).
 - Lots of discussion regarding hazardously misleading information.
 - Would WAAS help this? Maybe not much.
 - Takeoff Go Around (TOGA) tunnel discussion
 - Vertical flight path defined
 - The tunnel could cause a low-speed LOC if pilots keep pulling up to stay in tunnel when the aircraft won't enable that high of a flight path.
 - Stall warnings would mitigate this.
 - This is a good research issue.
 - Has the FAA bought-off on the boxes (tunnel)
 - SMAD has
 - CDI is the primary reference (lateral nav).
 - En Route: tunnel off option
 - Future FAA cert of tunnels to be done on a case by case basis
 - Box/tunnel flight technical error (FTE)
 - En Route: tunnel in FOV, no needle deflection
- Flight below MDA
 - Training issue to avoid abuse of the system.
- NASA/Chelton discussion. Why is the NASA concept harder to fly?
 - Lots of discussion
 - Issue was resolved through demonstration flights to Rick Price (Chelton) and August Asay (FAA, Anchorage ACO). Lou Glaab and Rob Rivers were onboard for the demo flights.
 - Both VVs (NASA and Chelton) behave similarly.
 - Use of the Chelton equipment for Capstone-2 employs a much lower level of FTE (.3 nm laterally (+/-1,800 ft)). This is based on non-precision approach standards.
 - NASA testing employed higher levels of FTE (+/- 100 ft laterally and +/- 80 ft vertically, or +/- 1 dot LOC and GS error) that are more like precision approach standards. Control of airspeed (+/-10kts) was also part of the NASA testing.
 - Different levels of required FTE create different levels of workload.
- Terrain presentation discussion
 - Can be hazardously misleading
 - Mitigating steps

- Use highest point (of 4) to set terrain elevation while down-sampling DEM
 - Use peaks database for DEM evaluations
- AK certification will have rippling effects (Chip Adam)
- SVS SA and terrain awareness is not a warning system
- FAA engineers are driving concern over hazardously misleading (HM) information.
- Some general comments regarding SVS:
 - Doesn't look threatening enough, remove it (SVS)
 - Looks threatening, shouldn't have it (SVS)
- Use of TAWS precedence
 - If reliable enough for TAWS, should be enough for SVS.
 - Point made that navigation using TAWS is not permitted.
 - Some Part 23 vs. Part 25 discussion
 - Comment about operational environment closer than 700 ft (TAWS warning) to set the required accuracy of the TAWS db.
 - TAWS "Pull Up" alerts could cause a stall which should put some premium on the accuracy of the TAWS databases.
 - Ground clearance is not guaranteed.

Chelton EFIS-2000/Capstone-2 (Rick Price):

- Ed- Rick provided a demonstration of the EFIS-2000 system running on a laptop and projected onto the screen. This was a great way to step through the various features of the EFIS-2000 system as it has been developed for the Capstone-2 program. A flight into, and around, Reno Nevada was simulated.
- Emphasized linear heading scale on Chelton SV concept
- Traffic advisory system, more like TCAS-1
- VV smoothing in displacement to reduce turbulence effects
- Update rate is about 20Hz
- "Free Run" mode is employed
- Transport delay
 - Data is updated at 45Hz
- Barometric temperature compensation was explored but the data required to perform the calculation made the calculation unworkable (i.e. where the baro pressure was recorded and when).
- "geometric altitude" = baro height – ground
- Chelton's presentation impressive from a practical system perspective, especially the flight path (rather than the terrain) aspects.
 - Bothersome issue is that their flight path marker apparently is air-mass based, making it more heavily damped in the vertical axis than what we used in the C206. There is a concern about how theirs performs in head and tail wind conditions (should follow up with personnel in Dynamics & Control Branch).

- Selected heading-up on MFD since heading-up is what is used on the PFD.
- Engine parameters: problem with multiple sensor vendors
- Route entry modifications can be performed in flight.
- There is some obstruction of information when entering information via PFD.
- Minimum range to the closest box/tunnel can reduce workload.
- Not being in the box/tunnel not a big deal.

Oct 23, 2002

Universal Vision-1 effort (Tom Johnson):

- Lots of discussion regarding Part-23 cert.
- Part-25 terrain db on PFD. No way to verify/assure terrain clearance with terrain db.
- Mis-use of SVS is a problem.
- Assumed operations
 - Proper/improper
- Universal Avionics faces a different FAA: no runway allowed, no terrain if TAWS warning active, no GPS-based information (no tunnel) allowed if ILS is available.
- Minimum Engineering Assessment Team (MEAT??) was formed to evaluate Vision-1 concept
 - Team empowered to make decisions regarding this system
 - Team composition was small (6?).
 - Aside from all the certification issues concerning the Universal system is the perception (fact) of different treatment depending on which FAA ACO is involved.
- Lots of subjective data, need objective data.

FAA SVS Certification Perspective (Lowell Foster):

- Discussion regarding terrain db providing HM information.
 - If it is good enough for TAWS, then should be OK for SVS
- Don't stop certification of equipment due to mis-use, since a lot of "certified" systems can be misused.
- FAA responsibility is to let the users know the limitation of equipment
- PFD terrain is just a backup to TAWS - TAWS is primary terrain information source
- HITS is just another 3-D flight director
- FPM concern is just a training issue (ERAU study is important for that reason)
- Mountainous night VFR flight may be a challenging situation. Pilots could use lower altitudes since they can "see" the terrain on the SVS display.
- TAWS mandate in GA?

- Mandates greater than \$400 to \$500 in cost put it beyond consideration
- Most GA airplanes don't have TAWS, so how is PFD terrain is just a backup to TAWS ?
- Fear of HM data on PFD is stifling progress.
 - Point made that current instruments can be misleading (tough to use).
- Fielding equipment can help learn a lot about them, more than testing/development can provide in a similar amount of time.
- No guarantee that extensive studies will catch everything anyway.
- NAV database process is uncertified.
- Stall cue should be in the center of the display
 - Emphasize low speed on display by replacing unusual attitude display with low speed warning
- Keep same team together for all SVS evaluations
 - Remove relative effects of personal bias
- Workload is driving characteristics of SVS concepts
- DO200 TAWS database – not to descend below MDA
 - Hard to separate SA and navigation roles of SVS
- Discussion of test pilots
- The role of the test pilot
 - High-hour pilots miss the naivety of low-hour pilots
 - But, they are trained to know better, observe and articulate better, look for gotchas.

Symbology Development for Head-Down Displays (Mamad Takallu):

- Discussion regarding custom-made approaches vs using published approaches
 - Aggressive approach/stabilized approach
- Missed approach point (MAP) single engine turn vs. turn/climb
- Developing approaches for SE AK (Don Streeter to supply information).
- RNP vs. approach capabilities
 - Need to develop research approaches that make sense
 - Apply RNP, if possible
 - Define other evaluation maneuver design considerations
- Opened discussion to what rare events/scenarios should be tested
 - Investigate workload issues on missed approach (gain altitude, then turn)
 - Temperature could be used to drive indicated altitude lower
 - Vectors below obstacle clearance
 - Path leads into terrain
 - GPS failure
 - Error in terrain model
 - Use existing approaches at Sun Valley, Jackson Hole, Aspen
 - Use realistic TERPs-based approaches

- Don Pate to provide reference for release of new procedures
- Nav display for evaluations
 - Probably should avoid using the MX-20 (update rate)
- How do we assess SA?
 - Interruption with objective measures
 - SAGAT
 - Rare Event scenarios
- How do we separate the effects of symbology and imagery?
 - Subjective vs objective argument
- It was suggested that as SA improves, workload decreases
 - Use this effect by measuring the amount of secondary tasks required to reach workload saturation
- The effects of training were discussed
- Obstacles for rotorcraft remain a big issue

**Certification Issues and Future Research Needs (Lou Glaab):
In a reasonable order of priority**

1. Terrain database accuracies
 - Real-time evaluations
 - Database integrity monitors
2. Hazardously Misleading information is a major concern
3. Training issues
4. Failure modes
 - Partial panel
 - Reversionary requirements
5. Aircraft attitude symbology
 - Lack of awareness
 - Prominence of attitude symbol
6. Visual cue and PIO
 - Sim world vs. actual flight world
7. Field of View
 - Depth perception
 - Maximum FOV
 - Useable minification factors
8. Size of tunnel
 - Guidance
 - FOV effects
 - Should tunnel scale with FOV?
9. Better reflection of certification issues in research
 - Perform an initial pseudo FAA perspective within NASA research
10. Display update rates and PIO susceptibility
11. Some discussion regarding the NASA Space Shuttle SRTM data ensued, although not really a certification issue.
 - Problems processing the data
 - Unsure of the schedule for release

